UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF AIR AND RADIATION

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LANDFILL GAS-TO-ENERGY PROJECTS, PUBLIC HEALTH, SAFETY AND THE ENVIRONMENT: QUESTIONS AND ANSWERS

The following questions and answers are provided to inform interested stakeholders about the health, safety and environmental issues related to exposure to landfill gas and to landfill gas combustion products. Should you have questions related to information provided in this document, please contact Ed Coe at EPA's Landfill Methane Outreach Program (202-564-8994) or Michele Laur at EPA's Office of Air Quality Planning and Standards (919-541-5256).

1. How is landfill gas generated?

Landfill gas is generated during the natural process of bacterial decomposition of municipal solid waste. Landfill gas is generated in varying amounts 24 hours a day, 7 days a week. A number of factors influence the quantity of landfill gas generated and the components/constituents in landfill gas. These factors include but are not limited to the types of waste/garbage in the landfill, moisture content in the waste, and temperature.

2. What components/constituents are found in landfill gas?

Typically, landfill gas consists of 50% methane, 48% carbon dioxide, small amounts of hydrogen, oxygen and nitrogen, and trace amounts of non-methane organic compounds (NMOCs). NMOCs include volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and odorous compounds.

3. What are the public health, safety and environmental concerns associated with landfill gas?

The public health, safety and environmental concerns fall into one of three categories. These categories are subsurface migration, surface emissions/air pollution and odor nuisance.

Subsurface Migration

Subsurface migration is the underground transmission of landfill gas to other areas within the landfill property and outside the landfill property. Since landfill gas contains approximately 50% methane, a potentially explosive gas, there is the risk that the gas will travel underground to private structures where it may accumulate and ignite resulting in destruction of property and injury or death. To date, there have been isolated incidences of fires located on landfill property, the destruction of private property and in some cases personal injury has occurred.

Surface Emissions

Possibly the biggest health and environmental concerns are related to the surface emissions of landfill gas into the air. As previously mentioned, landfill gas contains carbon dioxide, methane, VOCs, HAPs and odorous compounds which can adversely affect public health and the environment. For example, carbon dioxide is currently linked to global climate change. In addition, methane's contribution to the greenhouse effect is 21 times greater than that of carbon dioxide. It is also known that VOCs contribute to ozone formation. Once formed, ozone is capable of reducing or damaging vegetation growth as well as causing respiratory problems in

humans. Finally, the health effects of exposure to HAPs can include cancerous and non-cancerous illnesses such as respiratory irritation and damage of the central nervous system.

Odors

The final concern related to landfill gas emissions is from its odorous characteristics. Compounds found in landfill gas are associated with strong pungent odors. These smells can be transmitted off site to nearby homes and business. This can lower the quality of life for individuals that live near landfills and can potentially result in a reduction in property values.

As you can see from the discussion above, there are a number of concerns related to landfill gas emissions. These concerns range from mild to severe.

4. Is EPA doing anything to protect public health, safety and the environment against these dangers?

The EPA promulgated Resource Conservation and Recovery Act (RCRA) Criteria for Municipal Solid Waste Landfills (40 CFR Part 258) on October 9, 1991. The criteria contain location restrictions, design and operating standards, groundwater monitoring requirements, corrective actions, financial assurance requirements, closure requirements and post closure requirements. Under the design standards new landfills and lateral expansions that occur on or after October 9, 1993 are required to line the bottom of the landfill prior to waste deposition. In addition, all landfills operating after October 9, 1991 must place a final cap over the landfill surface. The placement of liners and caps reduces the potential for subsurface methane migration and groundwater contamination. In addition, EPA promulgated the New Source Performance Standards and Emission Guidelines for Municipal Solid Waste Landfills in March 1996. These standards apply to large existing and new landfills and require the collection and combustion of landfill gas if the landfill has the potential to emit 50 Mg/year or more of non-methane organic compounds. The end result of EPA's efforts is a significant reduction in landfill gas emissions and the related adverse health and environmental effects because the combustion of landfill gas destroys these pollutant emissions that would otherwise be released.

5. Can landfill gas combustion be used as an energy source?

Yes. Landfill gas is approximately 50% methane, the major component of natural gas. Landfill gas can be used to create electricity or heat. Using landfill gas as an energy source not only results in the destruction of harmful components in landfill gas but also displaces fossil fuel that would otherwise have been burned to generate energy. This helps the public breath a little easier since the emissions associated with the displaced fossil fuel are not released.

6. There is some concern that these projects (i.e. landfill gas-to-energy projects) may produce dioxin. How is dioxin formed?

Dioxins are formed during the combustion process in the presence of specific organics and particulate matter. Some of the conditions that are conducive to dioxin formation are the combustion of organic material in the presence of chlorine and particulate matter under certain thermodynamic conditions such as low temperatures and combustion times. Unstable transient combustion conditions as well as the presence of particulate matter containing metals and the presence of soot also favor the formation of dioxin.

7. What are some sources of dioxins?

Sources of dioxin include but are not limited to municipal solid waste combustors, residential and commercial coal combustion, residential and commercial oil combustion, backyard trash burning, residential fireplaces, cars, cigarettes, forest and brush fires, combustion of landfill gas and many others.

8. Did the EPA examine whether landfill gas-to-energy projects produce dioxin, and if so, how do these levels compare with other sources?

As EPA developed the New Source Performance Standards and Emission Guidelines for Municipal Solid Waste Landfills, it examined domestic and international studies on dioxin emissions from the combustion of landfill gas. EPA found that available data was limited for the various types of combustion devices. However, a review of available data indicated that the characteristics of landfill gas combustion are not conducive to dioxin formation. In addition, EPA found that a municipal waste combustor meeting the 1995 promulgated regulatory requirements had the potential to emit twenty nine times more dioxin than the highest level of dioxin emissions measured from the combustion of landfill gas in the United States.

More recently, EPA has produced a draft report, The Inventory of Sources of Dioxin in the United States (EPA/600/P98/002Aa). The final report will be released by late 1999. This report contains more current estimates of dioxin emissions by source and indicates that emissions from the combustion of landfill gas are comparable to oil or coal combustion. Finally, it indicates that dioxin emissions from combustion of landfill gas are 75 to 430 times less than those from municipal waste combustion. In summary, EPA believes that the potential for dioxin emissions from the combustion of landfill gas is small.